QCD-TNT International Workshop on QCD Green's Functions, Confinement, and Phenomenology
September 7-11 2009
ECT* Trento, Italy

Speakers

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3. Bicudo, P
4. Binosi, D
5. Blaizot, J-P
6. Chiu, T-W
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11. de Forcrand, Ph
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21. Kondo, K-I
22. Langfeld, K
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24. Mathieu, V
25. Mehta, D
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27. Millo, R
28. Minkowski, P
29. Nair, V. P.
30. Natale, A
31. Olejnik, S
32. Oliveira, O
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36. Quadri, A
37. Ratti, C
38. Reinhardt, H
39. Rodriguez-Quintero, J
40. Sauli, V
41. Semenoff, G W
42. Simonov, Y
43. Skullerud, J
44. Suganuma, H
45. Szczepaniak, A
46. Tandy, P
47. Trusov, M
48. Vandersickel, N
49. Weise, W
50. Zakharov, V

Attendees

1. Cristoforetti, M
2. Fontoura, C
3. Hovhannisyan, K
4. Ibanez, D
5. Vercauteren, D

Final Programme*

		Sept 7	Sept 8	Sept 9	Sept 10	Sept 11
9:15	**9:50**	Greensite	Cornwall	Zakharov	Blaizot	Weise
9:50	**10:25**	Simonov	de Forcrand	Szczepaniak	D'Elia	Semenoff
10:25	**11:00**	Lavelle	Langfeld	Olejnik	Hands	Ratti
11:00	**11:30**			Coffee break		
11:30	**12:05**	Mendes	Suganuma	Minkowski	Nair	Ilgenfritz
12:05	**12:40**	Papavassiliou	Giusti	Reinhardt	Philipsen	Antonov
13:00	**14:30**			Lunch		
14:30	**15:05**	Creutz	Binosi	Chiu	Aguilar	Sauli
15:05	**15:40**	Pene	Gracey	Tandy	Dudal	Bicudo
15:40	**16:15**	Rodriguez-Quintero	Kondo	Cucchieri	Vandersickel	Ilderton
16:15	**16:45**			Coffee break		
16:45	**17:20**	Forkel	Ferrari	Oliveira	Mehta	Mathieu
17:20	**17:55**	Natale	Quadri	Skullerud	Trusov	Millo

*All talks are assumed to be in the format 30+5

Contributed Talks

Speaker: Aguilar, C

Institution: Federal University of ABC

Title: Non-perturbative QCD effective charges

Abstract: Using recent results for the gluon and ghost propagators, obtained from Schwinger-Dyson equations and large-volume lattice simulations, we construct the non-perturbative effective charge of QCD. We use two different definitions, which, despite their distinct field-theoretic origin, give rise to qualitative comparable results, by virtue of a novel non-perturbative identity. Most importantly, the QCD charge obtained with either definition freezes in the deep infrared, in agreement with theoretical and phenomenological expectations. The various theoretical ingredients necessary for this construction are reviewed in detail, and some typical misconceptions are briefly discussed.

Speaker: Antonov, D

Institution: Institut fuer Physik, Universitaet Bielefeld

Title: Shear viscosity of the gluon plasma in the stochastic-vacuum approach

Abstract: A nonperturbative calculation of the shear viscosity of the gluon plasma in SU(3) YM theory within theory within the stochastic vacuum model will be presented. The result for the ratio of the shear viscosity to the entropy density, proportional to the squared chromo-magnetic gluon condensate and the fifth power of the correlation length of the chromo-magnetic vacuum, falls off with the increase of temperature. At temperatures larger than the deconfinement critical temperature by a factor of 2, this fall-off is determined by the sixth power of the temperature-dependent strong-coupling constant and yields an asymptotic approach to the conjectured lower bound of $1/(4\pi)$, achievable in ${\cal N}=4$ SYM theory. The bulk viscosity of the gluon plasma is also calculated by the same method and compared with the known perturbative results.

Speaker: Bicudo, P

Institution: CFTP, Instituto Superior Tecnico, LISBOA

Title: Schwinger-Dyson equations and the quark-antiquark static potential

Abstract: In lattice QCD, a confining potential for a static quark-antiquark pair can be computed with the Wilson loop technique. This potential, dominated by a linear potential at moderate distances, is consistent with the confinement with a flux tube, an extended and scalar system also directly observable in lattice QCD. Quantized flux tubes have also been observed in another class of confinement, the magnetic confinement in type II superconductors. On the other hand the solution of Schwinger Dyson Equations, say with the Landau gauge fixing and the truncation of the series of Feynman diagrams, already at the rainbow level for the self energy and at the ladder level for the Bethe Salpeter equation, provides a signal of a possible inverse quartic potential in momentum space derived from one gluon and one ghost exchange, consistent with confinement. Here we address the successes, difficulties and open problems of the matching of these two different perspectives of confinement, the Schwinger-Dyson perspective versus the flux tube perspective.

Speaker: Binosi, D

Institution: ECT* Trento

Title: On the dynamics of the Kugo-Ojima function

Abstract: The modern formulation of the pinch technique makes extensive use of the Batalin-Vilkovisky quantization formalism. In this framework a certain auxiliary function, usually denoted by G, plays a prominent role.
In this talk I will review its properties and show that in the (background) Landau gauge it fully constrains the QCD ghost sector as well as the IR dynamics. In particular, it will be shown that G coincides with the Kugo-Ojima function u. The determination of the behavior of G (and therefore of the Kugo-Ojima function) for all momenta through a combination of the available lattice data on the gluon and ghost propagators and the dynamical equation G satisfies, will be also discussed.

Speaker: Blaizot, J-P

Institution: IPhT - Saclay

Title: TBA

Abstract: TBA

Speaker: Chiu, T-W

Institution: Physics Department, National Taiwan University

Title: Topological quantum fluctuations in the QCD vacuum

Abstract: The QCD vacuum constitutes various quantum fluctuations which are the origin of many interesting and important non-perturbative physics, such as the spontaneously chiral symmetry breaking, and color confinement. One of the salient features of the QCD quantum fluctuations is its non-trivial topology. Thus it is important to determine the topological charge fluctuations of the QCD vacuum. In this talk, I review the current status of the determination of the topological susceptibility, the second normalized cumulant, and related physical quantities, in unquenched lattice QCD.

Speaker: Cornwall, J M

Institution: University of California, Los Angeles

Title: Open issues in confinement, for the lattice and for center vortices

Abstract: Center vortices have been around for more than thirty years, well-confirmed on the lattice, and very successful in explaining the basics of confinement, yet there are still open questions unstudied either on the lattice or in theory. The first is that basic confinement in the center vortex picture is topological and makes no reference to any particular surface (whose area would appear in the area law) or fluctuation dynamics of this surface. Only in d=2 (flat Wilson loops) is it obvious what surface must be involved, and in this dimension there is no room for fluctuations. This makes it hard to understand the Luscher term and other properties of the fluctuating confinement surface for d>2. I make the obvious, but unconfirmed to date, conjecture that in topological confinement for non-planar Wilson loops the area law is the exponential of a string tension times the area of a minimal surface spanning the Wilson loop, which would lead to a Luscher term. Closely-related is-

sues are the structure of the area law for two coaxial Wilson loops, as the distance between them along the axis grows; the resulting Casimir force between hadrons; and the behavior of k-string tensions for SU(N) with N>3. I suggest a program of both lattice and theoretical studies, focused on center vortices and the pinch technique, to explore these and other issues: 1) Calculate the area law for non-planar Wilson loops, or for pairs of flat Wilson loops, in a center-vortex-like ground state with a gas of vortices, but with no gluon-Wilson loop coupling. 2) Extend beyond perturbation theory the old lattice work of Dashen and Gross on background-field Feynman gauge fixing to extract the gauge-invariant off-shell Green's functions of the pinch technique. 3) Study more closely a picture I outline here of reconciling center vortices and minimal surfaces with fishnet graphs and the gluon-chain model, with the key ingredient of dynamically-massive gluons.

Speaker: Creutz, M

Institution: Brookhaven National Laboratory

Title: Anomalies and chiral symmetry in QCD

Abstract: The quantum anomaly that breaks the U(1) axial symmetry of massless QCD leaves behind a flavor-singlet discrete chiral invariance. When the mass is turned on, this residual symmetry has a close connection with the strong CP violating parameter theta. One result is that a first order transition is usually expected when the strong CP violating angle passes through pi. This symmetry can be understood either in terms of effective chiral Lagrangians or in terms of the underlying quark fields.

Speaker: Cucchieri, A

Institution: IFSC--University of São Paulo

Title: Simulating linear covariant gauges on the lattice: a new approach

Abstract: We present a new implementation of the linear covariant gauge on the lattice. In particular, we discuss details of the numerical procedure for fixing the gauge. We also present preliminary results for the transverse and longitudinal gluon propagators for the SU(2) gauge group in four space-time dimensions.

Speaker: D'Elia, M

Institution: University of Genoa & INFN

Title: Magnetic Monopoles in the Deconfined Phase of Yang-Mills Theories

Abstract: We discuss recent lattice results concerning the properties and the role of abelian magnetic monopoles in the high temperature phase of Yang-Mills theories..

Speaker: de Forcrand, Ph

Institution: ETH Zuerich

Title: Confinement in (4+1) dimensions

Abstract: Drawing on the analogy with U(1) lattice gauge theory in (3+1) dimensions, I explain how to study confinement in 4d Yang-Mills theory with one extra, compact dimension on the lattice. The phase diagram of this theory and the limits placed by its non-renormalizability are clarified.

Speaker: Dudal, D

Institution: Ghent University

Title: Aspects of the Gribov-Zwanziger framework

Abstract: As it is well-known, the existence of gauge Gribov) copies disturbs the usual Faddeev-Popov quantization procedure in the Landau gauge. It is a very hard job to treat these in the continuum, even in a partial manner. A decent way to do so was worked out by Gribov, and later on by Zwanziger. The final point was a renormalizable action (the GZ action), implementing the restriction of the path integration to the so-called Gribov region, which is free of a subset of gauge copies (but not all). Till recently, everybody agreed upon the fact that the restriction to the Gribov region implied a infrared enhanced ghost, and vanishing zero momentum gluon propagator. We discuss how the GZ action very naturally leads to the existence of vacuum condensates of dimension two. As it is very common, such condensates can seriously alter the dynamics. In particular, the GZ condensates correct the gluon propagator to a nonvanishing zero momentum limit, and reconstitute an nonenhanced ghost. We call this the refined GZ (RGZ) framework. The predictions are in agreement with most recent lattice simulations, and certain solutions of the Schwinger-Dyson equations. A crucial feature of the GZ framework is the soft (controllable) breaking of the BRST symmetry. We discuss it using a toy model and argue that such a soft BRST breaking could be useful to define physically relevant operators in the GZ framework (see also talk of N. Vandersickel). We end by pointing out that imposing the famous Kugo-Ojima (KO) confinement criterion on the theory as a boundary condition from the beginning leads to the same partition function as of GZ, with associated BRST symmetry breaking. This clouds the interpretation of the KO criterion in se. In addition, the aforementioned condensates will shift the propagators away from what naively could be thought.

Speaker: Ferrari, R

Institution: MIT & Milano University

Title: Beyond renormalization: an essay on nonlinear sigma model, massive YM and Electroweak Model

Abstract: In power counting renormalizable theories there is a universally accepted rule, by which to every divergent one-particle-irreducible amplitude one must associate an independent parameter in the tree-level action. This rule cannot be exported to any program of subtraction of infinities in nonrenormalizable theories. We present a subtraction scheme for some nonrenormalizable theories, as nonlinear sigma model, massive YM and Electroweak Model, which preserves locality and physical unitarity and does not require an infinite number of independent parameters. This open the practical possibility to perform consistent radiative corrections. The phenomenological implications are very important.

Speaker: Forkel, H

Institution: Humboldt-Universitaet zu Berlin

Title: Correlators as Holograms

Abstract: We derive and analyze predictions of current AdS/QCD duals for hadron correlators.
We confront the results with QCD information from the lattice, hadron spectroscopy, diquark correlations, from the operator product expansion and from low-energy theorems. The examined dual

backgrounds turn out to encode complementary aspects of nonperturbative QCD. The OPE Wilson coefficients, in particular, are shown to provide a challenging testing ground for the UV sector of holographic predictions.

Speaker: Giusti, L

Institution: CERN and University of Milano-Bicocca

Title: On the Banks-Casher relation with Wilson fermions

Abstract: I will discuss how to design new probes of the chiral regime of QCD by using the Banks-Casher relation. I will then focus on the use of spectral observables to define the chiral condensate and the topological susceptibility with Wilson fermions without ultraviolet power divergences to be subtracted. First numerical results for the chiral condensate with O(a)-improved Wilson fermions and two dynamical flavours will be presented.

Speaker: Gracey, J

Institution: University of Liverpool

Title: The static potential in the Gribov-Zwanziger Lagrangian.

Abstract: We discuss the construction of the one loop static potential in the MSbar scheme in the Gribov-Zwanziger Lagrangian which incorporates the Gribov horizon in the Landau gauge. The one loop potential recovers the known gauge independent perturbative potential in the zero Gribov mass limit. Properties of the full one loop potential are discussed.

Speaker: Greensite, J

Institution: San Francisco State University

Title: Aspects of Confinement in Coulomb Gauge

Abstract: I show that i) a recent proposal for the Yang-Mills vacuum wavefunctional in D=2+1 leads to a linear Coulomb potential; ii) constituent gluons in quark-antiquark states bring the value of the Coulomb string tension in D=3+1 much closer to that of the static quark potential. If time permits, I may also discuss a new semi-perturbative treatment of the Fadeev-Popov eigenvalue spectrum.

Speaker: Hands, S

Institution: Swansea University

Title: Lattice Study of Dense Two Color Matter

Abstract: I will present results from lattice simulations of Two Color QCD with two quark flavors in the presence of a quark chemical potential. I will show results for the equation of state, superfluid order parameter, and Polyakov line, and argue that the transitions from hadronic to quark matter, and from confined to deconfined matter, occur at distinct values of mu.

Speaker: Ilderton, A

Institution: Trinity College, Dublin

Title: Physical charges in QED and QCD

Abstract: Lagrangian fermions in QCD and QED do not on their own describe physical particles, even asymptotically. The reason is that the coupling never switches off (and assuming it does so generates infra-red problems), so the matter fields are never gauge invariant. The `dressing' approach describes charges as gauge invariant composites of the matter fields and clouds of gauge bosons. Such dressed states are both physical and natural -- imposing only gauge invariance, we minimise the gauge theory Hamiltonian and show that the ground state is described by dressed matter. In QCD we show that there is a nonperturbative obstruction to the construction of physical quark states, intimately tied to the Gribov ambiguity. We demonstrate explicitly how Gribov copies prevent a nonperturbative definition of colour charge.

Speaker: Ilgenfritz, E-M

Institution: Institut fuer Theoretische Physik, Universitaet Heidelberg

Title: Multidyon picture for confinement and deconfinement

Abstract: I will give an introduction into a picture of confinement based on the notion of caloron constitu ents (dyons). These constituents originate from the generalization (by van Baal and others) of finite-temperature instantons (calorons) to accomodate symptotically nontrivial holonomy. I will discuss the status of lattice evidence for such an picture and report on numerical simulations of corresponding models on and off the lattice.

Speaker: Kondo, K-I

Institution: Chiba University

Title: Gribov-Zwanziger horizon condition, ghost and gluon propagators and Kugo-Ojima confinement criterion

Abstract: We discuss how the restriction to the Gribov region restricts the possible value for the Kugo-Ojima parameter for color confinement and ghost dressing function. Within the Gribov-Zwanziger theory, (1) we prove that the Kugo-Ojima color confinement criterion u(0)=-1 is not satisfied in a naive form u(0)=-2/3, (2) we prove that the ghost propagator behaves like free in the deep infrared regime, (3) we give a general field theoretical argument supporting that the gluon propagator is non-vanishing at low momenta, in harmony with recent lattice results and decoupling solution of the Schwinger-Dyson equation. We also discuss a nilpotent BRST like symmetry in the Gribov-Zwanziger theory.

Speaker: Langfeld, K

Institution: University of Plymouth

Title: A fresh look at the confinement mechanism

Abstract: The idea that colour confinement in Yang-Mills theories is induced by certain topological degrees of freedom which are abundant in the vacuum has a long history. While semi-classical configurations (such as instantons) so far could not be linked with confinement, lattice evidence accumu-

lated over the recent decade has underpinned the relevance of singular configurations (monopoles or vortices) for the Yang-Mills low energy sector. While the connection of these configurations to confinement is quite evident, the subtle and intrinsically fine tuned balance between their (singular) energy and their entropy is not yet understood. In my talk, two novel low energy filters will be discussed which are able to shed new light onto configurations bearing confinement: (i) The truncated spectral sum of eigenmodes of the quark operator provides a gauge invariant low energy projector. This filter is used to further examine the relation between chiral symmetry breaking and confinement. (ii) A novel cooling mechanism is introduced which largely reduces the action while preserving the linear confining potential. First results will be presented. The method could provide access to an understanding of confinement at the semi-classical level.

Speaker: Lavelle, M

Institution: University of Plymouth

Title: Infra-red problems and a response

Abstract: The standard approach to the infra-red problem is to sum over degenerate final states to remove soft divergences (Bloch-Nordsiech), and over both initial and final states for collinear divergences (Lee-Nauenberg). We show that this division is inconsistent, and further that the Lee-Nauenberg recipe leads to ill-defined results in a variety of theories. We then argue that infra-red divergences are due to using unphysical variables to describe in and out states and introduce gauge invariant, physical `dressed' states. Perturbative and non-perturbative properties of physical electron and quark states are then discussed.

Speaker: Mathieu, V

Institution: Université de Mons

Title: Gluon Mass and Glueball Spectrum

Abstract: Non perturbative effects leads to a dynamically generated mass for the gluon without violating the Ward identity and gauge invariance. One can then wonder how many degrees of freedom has the gluon since massless and massive representation of the Poincaré group has respectively two and three polarizations. I review the history of both possibilities investigated in the literature. I compare the implications of the two approaches on the glueball spectrum. The lattice data of glueball spectroscopy reveals the lack of low-lying vector states. This would implies only two polarization states for the gluon. However, this conlusion should be confirmed by experiments.

Speaker: Mehta, D

Institution: National University of Ireland Maynooth

Title: Lattice Landau Gauge and Algebraic Geometry

Abstract: On the lattice, the standard way to fix Landau gauge is to minimizing the so-called lattice Landau gauge (LLG)-fixing functional numerically. Minimizing a multivariate function efficiently is one of the fundamental problems in many branches of theoretical physics. The conventional numerical minimization methods such as Simulated Annealing and Over-relaxation are known to fail in obtaining the global minimum. We observe that the extremizing equations for the LLG-fixing functional and, in general, for multivariate functions arising in many physical phenomena have

'polynomial-like' non-linearity. After explaining how one can transform the extremizing equations for the LLG, for the compact U(1) case as an example, to a system of multivariate polynomial equations, we propose two methods to solve these equations and obtain all the extrema of the LLG-fixing functional. The first method is the Groebner basis technique which can solve the systems of multivariate polynomial equations and hence give the global minimum exactly. The second method is called the Numerical Polynomial Homotopy Continuation method which gives all solutions of the systems of polynomial equations and thus giving the global minimum up to the machine precision. We demonstrate our preliminary results from both these methods.

Speaker: Mendes, T

Institution: University of Sao Paulo

Title: Numerical test of the Gribov-Zwanziger scenario in landau gauge

Abstract: We present the status of our lattice simulations of gluon and ghost propagators in SU(2) Landau gauge, including the extrapolation to infinite lattice sizes and the study of the beta = 0 case.

Speaker: Millo, R

Institution: University of Trento

Title: Effective Action for Low-Energy Quantum Field Fluctuations

Abstract: In this work, we present a novel approach to investigate the non-perturbative QFT dynamics, in which specific vacuum field fuctuations (e.g. instantons, vortices, monopoles, ...) are treated as the low-energy dynamical degrees of freedom, while all other field configurations are explicitly integrated out from the path integral. We show how to compute the effective interaction for the low-energy degrees of freedom both perturbatively (using stochastic perturbation theory) and fully non-perturbatively (using lattice field theory simulations). The present approach holds to all orders in the couplings and does not rely on the semi-classical approximation. We first discuss a simple toy model which allows us to illustrate the formalism and test the results against ab-initio numerical simulations. Then, we report on our recent progress towards the generalization to non-abelian gauge theories.

Speaker: Minkowski, P

Institution: ITP, University of Bern

Title: QCD as basic field theory: diffculties to build new bridges from perturbative regions to simple properties of hadrons

Abstract: TBA

Speaker: Mueller-Preussker, M

Institution: Humboldt-University Berlin

Title: Gluon and ghost propagators on the lattice

Abstract: In this talk we are going to present an overview of recent lattice computations of Landau gauge

gluon and ghost propagators in pure gauge theories with special emphasis on Gribov copy and finite-size effects, on the continuum limit and a comparison with lattice perturbation theory.

Speaker: Nair, P

Institution: City College of New York

Title: The Hamiltonian Approach to Yang-Mills (2+1): An Update and Corrections to String Tension

Abstract: Yang-Mills theories in 2+1 (or 3) dimensions are interesting as nontrivial gauge theories in their own right and as effective theories of QCD at high temperatures. I shall review the basics of our Hamiltonian approach to this theory, emphasizing symmetries with a short update on its status. We will show that the calculation of the vacuum wave function for Yang-Mills theory in 2+1 dimensions is in the lowest order of a systematic expansion. Expectation values of observables can be calculated using an effective interacting chiral boson theory, which also leads to a natural expansion as a double series in the coupling constant (to be interpreted within a resummed perturbation series) and a particular kinematical factor. The calculation of the first set of corrections in this expansion shows that the string tension is modified by about -0.3 % to -2.8% compared to the lowest order value. This is in reasonable agreement with lattice estimates.

Speaker: Natale, A

Institution: Instituto de Física Teórica - UNESP

Title: QCD phenomenology with infrared finite SDE solutions

Abstract: The reach of perturbative QCD can be improved with the use of solutions of infrared finite Schwinger-Dyson equations (SDE) for the gluon propagator and coupling constant. The mass scale appearing in these quantities acts as a natural infrared cutoff and its effect may be perceptible in different physical processes, like hadronic form factors and cross sections, as well as in heavy quark decays. We discuss how SDE solutions can be used to perform phenomenological calculations in the context of dynamical perturbation theory at tree level and beyond. Difficulties in the implementation of this procedure are commented.

Speaker: Olejnik, S

Institution: Inst. Phys., Slovak Acad. Sci., Bratislava

Title: Vacuum structure and Casimir scaling in Yang-Mills theories

Abstract: The vacuum of Yang-Mills theories can be imagined as a magnetically disordered medium with domain structure, with color magnetic flux in each domain quantized in units corresponding to the gauge group center. This model leads to the prediction of Casimir scaling, i.e. the proportionality of string tensions of potentials (at intermediate distances) between color sources from higher-representations to eigenvalues of the quadratic Casimir operator. We present evidence for Casimir scaling in G_2 lattice gauge theory. We also discuss support for some ingredients of the model from the recently conjectured form of the Yang-Mills ground-state wave-functional.

Speaker: Oliveira, O

Institution: University of Coimbra, Portugal

Title: The lattice infrared Landau gauge gluon propagator: from finite volume to the infinite volume

Abstract: We report the latest results obtained, by the Coimbra group, on the infrared behaviour of the lattice gluon propagator. The bounds on D(0) and their behaviour with the lattice volume are investigated, together with the full propagator. Moreover, a study of the gluon propagator using different lattices spacings is carried out.

Speaker: Papavassiliou, J

Institution: University of Valencia

Title: Gluon masses without seagull divergences

Abstract: Dynamical gluon mass generation has been traditionally plagued with seagull divergences. All regularization procedures proposed over the years yield finite but scheme-dependent gluon masses. In this talk we show how such divergences can be eliminated completely, by virtue of a characteristic identity, valid in dimensional regularization. The ability to trigger the aforementioned identity hinges crucially on the particular Ansatz employed for the three-gluon vertex entering into the Schwinger-Dyson equation governing the gluon propagator. The use of the appropriate three-gluon vertex brings about an additional advantage: one obtains two separate (but coupled) integral equations, one for the effective charge and one for the gluon mass. This system of integral equations has a unique solution, which unambiguously determines these two quantities. Most notably, the effective charge freezes in the infrared, and he gluon mass displays in the ultraviolet power-law running, in perfect agreement with earlier considerations.

Speaker: Pene, O

Institution: LPT Orsay (CNRS)

Title: A Ghost Story: Ghosts and Gluons in the IR of QCD

Abstract: The infrared (IR) behavior of QCD is an important issue in view of understanding confinement. We argue that it is fruitful to combine and confront lattice QCD and Dyson-Schwinger equations (DSE). We show that there are two classes of solutions to DSE, one with a finite strong coupling constant in the IR and a divergent ghost dressing function, the other with a vanishing coupling constant and a finite ghost dressing function. The latter is in much better agreement with LQCD.

Speaker: Philipsen, O

Institution: University of Muester

Title: Screened perturbation theory for 3D Yang-Mills and hot QCD

Finite temperature perturbation theory for QCD suffers from the well-known Linde problem, i.e. IR divergences due to massless interacting gauge particles. The problem can be isolated to the zero mode sector and is identical to that in a 3d pure gauge theory. The divergence is cured by dynamical generation of a magnetic mass, which however requires the summation of all loop orders and thus is entirely non-perturbative. I discuss various resummation schemes that were proposed in the past, and present two-loop contributions to the thermodynamic pressure of YM theory.

Speaker: Quadri, A

Institution: Univ. di Milano & INFN, Sez. di Milano

Title: The Electroweak Model based on the Nonlinearly Realized Gauge Group

Abstract: The electroweak model is formulated on the nonlinearly realized gauge group SU(2) X U(1). This implies that in perturbation theory no Higgs field is present. We discusss the effective action at the tree level, the Slavnov-Taylor identity (necessary for the proof of unitarity), the local functional equation (used for the control of the amplitudes involving the Goldstone bosons) and the subtraction procedure (nonstandard, since the theory is not power-counting renormalizable). Particular attention is devoted to the number of independent parameters relevant for the vector mesons; in fact there is the possibility of introducing two mass parameters. With this choice the relation between the ratio of the intermediate vector meson masses and the Weinberg angle depends on an extra free parameter. Uniqueness of the tree-level effective action of the nonlinearly realized electroweak model is established. The model is formulated in the Landau gauge for sake of simplicity and conciseness: the QED Ward identity has a simple and intriguing form.

Speaker: Ratti, C

Institution: SUNY Stony Brook

Title: The role of monopoles in a gluon plasma

Abstract: We study the role of magnetic monopoles at high enough temperature T>2T_c, when they can be considered heavy, rare objects embedded into matter consisting mostly of the usual ``electric quasiparticles, quarks and gluons. We study classical and quantum charge-monopole scattering, solving the problem of gluon-monopole scattering for the first time. We find that, while this process hardly influences thermodynamic quantities, it does produce a large transport cross section, significantly exceeding that for pQCD gluon-gluon scattering up to quite high T. Thus, in spite of their relatively small density at high T, monopoles are extremely important for QGP transport properties, keeping viscosity small enough for hydrodynamics to work at LHC.

Speaker: Reinhardt, H

Institution: Tübingen University

Title: Hamiltonian approach to Yang-Mills theory in Coulomb gauge

Abstract: I review recent results obtained in the Hamiltonian approach to Yang-Mills theory in Coulomb gauge

Speaker: Rodriguez-Quintero, J

Institution: University of Huelva

Title: A ghost story (II): Ghost, Gluons and the Gluon Condensate beyond the IR of QCD

Abstract: Beyond the deep IR, the analysis of ghost and gluon propagators still keeps very interesting

non- perturbative information. The Taylor-scheme coupling constant can be computed and applied to obtain the Lambda QCD parameter from Landau gauge lattice simulations. Furthermore, a dimension-two gluon condensate, that can be understood in the instanton liquid model, plays an important role in the game.

Speaker: Sauli, V

Institution: CFTP IST Lisbon

Title: General method of solution of Schwinger-Dyson equations in Minkowski space

Abstract: Novel solutions of Minkowski QED2+1 and QCD Schwinger-Dyson equations will be presented and discussed. The resultant propagators of confined degrees of freedom will be shown.

Speaker: Semenoff, G W

Institution: University of British Columbia

Title: Large representation Polyakov loop in hot Yang-Mills theory

Abstract: We consider the expectation value of the Polyakov loop operator in large representations of the gauge group in the deconfined phase of large N finite temperature Yang-Mills theory. We argue that this expectation value has some properties which are a diagnostic of features of the large N limit. We comment on the k-string tension.

Speaker: Simonov, Y

Institution: Institute of Theoretical and Experimental Physics

Title: Confinement, deconfinement and chiral symmetry breaking in QCD

Abstract: Nonperturbative (np) phenomena in QCD are shown to be generated by strong vacuum fields, which are naturally measured by field correlators. In the first part of talk it is shown that np quantities are expressed through the lowest (quadratic) correlators with few percent accuracy, and one specific correlator explains quantitatively confinement and chiral symmetry breaking, while its vanishing at $T>T_c$ explains deconfinement. In the second part of talk, field correlators themselves are calculated in background field formalism and are shown to be generated by gluelumps, which are again calculated via field correlators. In this way one obtains a selfconsistent set of equations. Convergence and accuracy of this set is discussed, and it is explained how seemingly different scales: string tension, gluonic condensate, glueball mass and Λ_{QCD} are expressed through the only one scale.

Speaker: Skullerud, J

Institution: NUI Maynooth

Title: Gluons and deconfinement at high density

Abstract: The Landau gauge gluon propagator is computed in 2-colour QCD at a range of chemical potentials and lattice spacings. We focus in particular on possible medium modifications in the high-density deconfined phase. We also comment on medium modifications of the quark propagator.

Speaker: Suganuma, H

Institution: Department of Physics, Kyoto University

Title: Lattice QCD Analysis for Gluons

Abstract: 1) In SU(3) lattice QCD, we analyze role of momentum-component of gluons in the Landau gauge, and extract the relevant gluonic energy scale for confinement. The relevant energy scale of color confinement is found to be below 1.5 GeV in the Landau gauge. In fact, the string tension is almost unchanged even after cutting off the high-momentum gluon component above 1.5 GeV. 2) We study the gluon propagator in the Landau gauge in SU(3) lattice QCD. The effective gluon mass is estimated to be about 400 - 600 MeV in the Landau gauge in an infrared region of r = 0.5 - 1.0 fm. We investigate the functional form of the gluon propagator in the Landau gauge in the region of r = 0.1 - 1.0 fm, which is relevant to quark-hadron physics. The gluon propagator is found to be well reproduced by the simple Yukawa-type function e^{-mr}/r in the four-dimensional Euclidean space-time. This Yukawa-type propagator in four-dimensional space-time corresponds to a new-type propagator of (p^2+m^2)^{-3/2} in the momentum space.

Speaker: Szczepaniak, A

Institution: Indiana University

Title: Gluon properties in magnetically confining vacuum

Abstract: We discuss construction of the Coulomb gauge vacuum wave functional which is dominated by a disordered gas of magnetic domains. The effect of vortices and monopoles on the Wilson loop and gluon and ghost propagators will be discussed. We show how to reconcile screening of the gluon propagator observed in the infrared with the long-range disorder demanded by confinement.

Speaker: Tandy, P

Institution: Center for Nuclear Research, Kent State University, USA

Title: How Much Meson Physics Can One Tie to DCSB?

Abstract: Continuum covariant QCD modeling, embedded in the ladder-rainbow truncation of the Dyson-Schwinger equations of QCD, performs well for the structure and interactions of light quark mesons if dynamical chiral symmetry breaking guides the infrared content. A quick summary of that will be followed by analysis of challenges that arise from dressing of the quark-gluon vertex, heavy quark mesons, light flavor mixing, and parton distribution functions for deep inelastic scattering.

Speaker: Trusov, M

Institution: ITEP, Moscow, Russia

Title: New developments of Dirac orbital approach in the low-energy QCD

Abstract: New developments and application results of Dirac orbital approach, based on the expansion of the hadron wave function into a product series of single quark bispinors, to phenomenological problems of the low-energy QCD, including hadron masses, mixings, form-factors, hadronic shifts

will be presented and discussed. The importance of lower Dirac bispinor components is stressed in these calculations.

Speaker: Vandersickel, N

Institution: Ghent University

Title: A candidate for the scalar glueball operator within the Refined Gribov-Zwanziger framework

Abstract: QCD suggests that in addition to the familiar hadrons made of quarks, there should also exist states where colored gluons play an important role, i. e. glueballs. However, after more than 30 years of searching, the experimental status is still very unclear, although there exist many indications that glueballs have been detected. On the theoretical side, various theoretical models have been developed. In this talk we shall propose a candidate for lightest scalar glueball operator thereby using the (refined) Gribov-Zwanziger action. This candidate is based on the unique renormalization group invariant operator containing $F^2_{\mu\nu}$. It shall also be demonstrated that the breaking of the BRST of the GZ action shall play an important role.

Speaker: Vento, V

Institution: University of Valencia

Title: Glueball enhancement by color deconfinement

Abstract: We study a scenario for high energy heavy ion collisions that leads to the formation of a strong coupling deconfined phase in which the lightest glueballs are numerous and stable. We analyze how their properties manifest themselves in experimental spectra and show that they provide a good signature for color deconfinement.

Speaker: Weise, W

Institution: TU Munich, Germany

Title: TBA

Abstract: TBA

Speaker: Zakharov, V

Institution: Max-Planck Institut fuer Physik, Muenchen

Title: Topological solutions in dual formulation of Yang-Mills theories

Abstract: Generically, dual formulations of Yang-Mills theory possess classical solutions due to non-trivial topology of extra dimensions. We concentrate on the geometry of the Sakai-Sugimoto model and consider both confining and deconfined phases. The topological solutions might play crucial role in understanding physics of the deconfining phase transition, viscosity of the Yang-Mills plasma, observation of 'event-by-event' violations of CP invariance in heavy ion collisions.